

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-241874

(43)Date of publication of application : 08.09.2000

(51)Int.Cl.

G03B 21/00

(21)Application number : 11-041428

(71)Applicant : NEC CORP

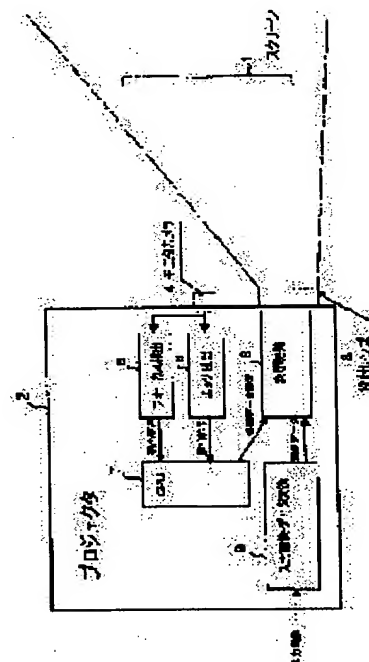
(22)Date of filing : 19.02.1999

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(54) METHOD AND DEVICE FOR AUTOMATICALLY ADJUSTING SCREEN POSITION FOR PROJECTOR**(57)Abstract:**

PROBLEM TO BE SOLVED: To automatically execute a focusing operation, a zooming operation up to a screen frame and a trapezoidal distortion control, etc.

SOLUTION: The projector 2 fixed facing a screen 1 is provided with a monitor camera 3 arranged on the front surface of the projector main body, a CPU 4 as a calculating part for processing information on a video signal inputted from the monitor camera 3 and calculating a focusing value, zooming value and a trapezoidal distortion control value, a display driving part 6 for adjusting a projecting lens 5 so as to execute the focusing operation, the zooming operation and the trapezoidal distortion control, and an inputted image data conversion part 7 for converting the inputted image to display data and outputting the data to the display driving part 6. Thus, a test pattern projected from the projector 2 on the screen 1 is picked up by the monitor camera 4, then, the data are analyzed, then, in addition to the focusing operation of the projector 2, the zooming operation up to the screen frame and the trapezoidal distortion control are executed based on the analysis results.

**LEGAL STATUS**

[Date of request for examination] 24.03.1999

[Date of sending the examiner's decision of rejection] 28.11.2001

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] In the screen justification equipment of the image display system which adjusts the location of the screen on which it was projected on the screen from the projector. The projector lens in which focus control, zooming, forward-and-backward inclination angle adjustment, and adjustment of a gate are possible, The monitor camera which picturizes the screen on which it was installed in the front face of a projector body, and was projected by the screen, A data-conversion means to change into digital data the information on the video signal inputted from said monitor camera, and to memorize it, The operation means which carries out data processing of the digital data changed by the data-conversion means, The focus control means of a projector lens, and the zooming driving means which carries out zooming of the projector lens, With a screen location detection means to detect the location of the screen in the screen picturized with the monitor camera, and said detected data of the location of a screen Automatic screen justification equipment of the projector characterized by having a projection direction adjustment means to perform forward-and-backward inclination angle adjustment of a projector lens, and a trapezoidal-distortion adjustment means by which said detected data of the location of a screen adjust the trapezoidal distortion of a projection screen.

[Claim 2] Said data-conversion means is automatic screen justification equipment of the projector according to claim 1 which changes into digital data the information which expresses the location and brightness on the scanning line of each pixel at least, and memorizes it from the video signal inputted from the monitor camera.

[Claim 3] Automatic screen justification equipment of the projector according to claim 1 or 2 which has the focal adjustment means of the distance measurement method using a supersonic wave.

[Claim 4] In the screen justification approach of an image display system of adjusting

the location of the screen on which it is projected on a screen from a projector, a predetermined test pattern is projected on a screen from a projector. Picturize the image of the test pattern on a screen with a monitor camera, analyze the image data of said picturized test pattern, and the focus of a projector is adjusted. Next, change a test pattern into the rectangular screen of all whites, and it projects on a screen. The location of the screen in the screen of all the whites picturized with the monitor camera is detected. The automatic screen justification approach of the projector which carries out zooming of the projector lens and is characterized by expanding or reducing a projection screen to the location of said detected screen, computing the adjustment value of a trapezoidal distortion from the location of the endpoint of said screen, and the endpoint of the screen of all whites, and adjusting the trapezoidal distortion of a projection image.

[Claim 5] Detection of the location of the screen in the image pick-up screen of said monitor camera is the automatic screen justification approach of the projector according to claim 4 which picturizes all the white screens on which it was projected towards the direction of a screen from the projector with a monitor camera, and judges the changing point of the brightness of the scanning line of an image pick-up screen as an endpoint of a screen.

[Claim 6] The adjustment value of said trapezoidal distortion is the automatic screen justification approach of a projector according to claim 4 or 5 of calculating, comparing the distance to the endpoint of all the white screens extended from the location of the endpoint of the screen in [said all / that was picturized] a white screen to horizontal and a perpendicular direction, and finding it, respectively about the side where the upper and lower sides of a screen and right and left counter.

[Claim 7] The automatic screen justification approach of the projector according to claim 4 or 6 which performs adjustment of said trapezoidal distortion with the projector lens which has optical gate equipment.

[Claim 8] The automatic screen justification approach of the projector according to claim 4 or 6 which performs adjustment of said trapezoidal distortion by amendment of the display-image data inputted into a projector lens.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the technique of screen justification of a portable mold projector in which the relative location of a projector and a screen is adjustable, especially about the image display system which projects an image on a large-sized screen by the CRT projector, a liquid crystal projector, etc.

[0002]

[Description of the Prior Art] About the screen adjustment approach of the above projectors, various means are indicated conventionally.

[0003] For example, about focus control, like a common auto-focus camera, the distance to an object is measured using infrared radiation or a supersonic wave, and the technique of adjusting the focus of a lens automatically according to the distance is known. As one of them, the "automatic-focusing projector" of JP,4-338706,A performs the focus of a projection lens with the measured distance using the ultrasonic transceiver component and zero cross circuit which measure the propagation time of the ultrasonic signal reflected on a screen, in order to perform the focus of portable mold projection equipment automatically.

[0004] Moreover, the "automatic image distorted compensator" of JP,8-088860,A In order to perform automatically raster distortion adjustment and convergence adjustment of a CRT method video projector By carrying out the expansion image pick-up of a part of image for adjustment projected on the screen from the video projector with a camera through a movable mirror, changing the image pick-up video signal into digital data, and carrying out an image processing by CPU Measuring automatically the raster deformation amount and the amount of convergence gaps of a coordinating point of a mxn point on a screen, and creating an amendment signal is indicated. The drive control location of the image pick-up means for picturizing the

corner section of a screen is inputted by the coordinator.

[0005] "The image display system and the focusing approach" of JP,10-090795,A The space optical modulator which forms the image which modulates the light of the light source and consists of a pixel (SLM), The optical system which carries out focusing of the image which the space optical modulator formed on an image plane, The sensor which senses at least one focus of the pixel projected on the image plane, and gives a sensor output, It has an adjustment means to change the parameter of optical system as a function of a sensor output. The image which irradiates light and is set to SLM from a pixel is decided to the image plane for a display. By adjusting as a function of the pixel sharpness which the sharpness of at least one pixel of the image has been sensed [sharpness], and had the optical parameter of optical system sensed, not the sharpness of the image projected but the sharpness of the pixel according to individual generated by SLM has been sensed, and the focus is established.

[0006] 3 Moreover, "the focal adjustment approach and equipment" of a plate type liquid crystal projector of JP,10-161243,A In order are accurate and to perform focus control of the screen for every color of green, red, and a blue 3 plate type liquid crystal projector for a short time The CCD camera which carries out the color image pick-up of the projection image projected by the 3 plate type liquid crystal projector on the screen, The A/D converter which digitizes the video signal of three photoed colors, and the image memory which memorizes the digital data of each color, It has the computing element which a focus suits for every color and evaluates condition as a focal value, and a display, focal distribution of the projection image of each color is searched for, and this distribution data is adjusting the focus.

[0007] Moreover, the method indicated by "the focus equipment of a color projector" of JP,2766229,B (JP,9-101447,A) In order to perform focusing point adjustment with high precision about the whole projection screen on the screen of the color projector which expands the image of an electrochromatic display indicator with a projection lens, and is projected on a screen The TV camera which picturizes the projection screen of a screen and outputs R, G, and B signal, respectively, R in each focus check field beforehand set as the central part and circumference part of a projection screen, G, and a level variation calculation means to compute the value which shows fluctuation of the signal level of B signal, respectively, A liquid crystal include-angle adjustment means to adjust the include angle of the liquid crystal side of an electrochromatic display drop, and the lens justification means which is made to move a projection lens and carries out focus control, It has the focus control means which controls a liquid crystal include-angle adjustment means and a lens justification means based on the calculation value for

every focus check field, respectively. Focus control is performed based on the level variation width of face of R of each image pick-up pixel in the focus check field which projected the image of all whites on the screen, carried out the package image pick-up of the projection screen with the color TV camera, and was beforehand set as the central part and circumference part of a projection screen, G, and B signal.

[0008]

[Problem(s) to be Solved by the Invention] In recent years, a projector and the projector of an especially highly efficient portable mold appear, and the opportunity of the presentation which can move easily is created by using together with a notebook computer. Although not only setting of a notebook computer but setting of a projector was required at that time, the adjustment for the setting needed time amount and skill, and had become a user's burden.

[0009] Especially for setting of the projector of a portable mold First, after making a projector and a screen counter and fixing on a floor or the standing ways of a desk and others, Outside it performs adjustment of the brightness of a screen, and focal adjustment of the projection image on a screen Although it is necessary to perform zoom adjustment to which even the screen frame of a screen expands and reduces a projection image, adjustment of the trapezoidal distortion of the screen by being aslant projected on an incident light line to a screen from the direction of the upper and lower sides or right and left, etc. It is restricted to an abbreviation automatic focus, the user is performing all other adjustments manually, and the conventional regulating means needed the time amount for it, and skill.

[0010] The purpose of this invention is in the projector equipment which expands an input signal and is displayed on a screen to offer the automatic screen justification approach and equipment of the projector which can adjust screen locations, such as zoom adjustment, trapezoidal-distortion adjustment, etc. to focal adjustment and a screen frame, automatically, without performing troublesome adjustment after installation.

[0011]

[Means for Solving the Problem] This invention tends to carry out various adjustments required for a display automatically by forming a monitor camera in equipment and carrying out the monitor of the projection screen.

[0012] Namely, the automatic screen justification equipment of the projector of this invention The projector lens in which focus control, zooming, forward-and-backward inclination angle adjustment, and adjustment of gate actuation are possible, The monitor camera which is installed in the front face of a projector body, and picturizes the

projection screen on a screen, A data-conversion means to change into digital data the information on the video signal inputted from the monitor camera, and to memorize it, The operation means which carries out data processing of the digital data changed by the data-conversion means, The focal adjustment means of a projector, and the zooming driving means which carries out zooming of the projector lens of a projector, A screen location detection means to detect the location of the screen in the image pick-up screen inputted from the monitor camera, A projection direction adjustment means to turn the optical axis of the incident light of a projector to the core of a screen with the data of the location of the screen detected by the screen location detection means, It has a trapezoidal-distortion adjustment means by which the data of the location of the screen detected by the screen location detection means adjust the trapezoidal distortion of a projection screen.

[0013] From the video signal inputted from the monitor camera, the information which expresses the location and brightness on the scanning line of each pixel at least is changed into digital data, and a data-conversion means memorizes it.

[0014] Moreover, the distance measurement method which used the supersonic wave is sufficient as a focal adjustment means.

[0015] The automatic screen justification approach of the projector of this invention A predetermined test pattern is projected on a screen from a projector. Picturize the image of the test pattern on a screen with a monitor camera, and analyze the data of the picturized monitor image and focal adjustment of a projector is performed. Next, change a test pattern into the rectangular screen of all whites, project on a screen, and it picturizes with a monitor camera. The location and circumference endpoint of a screen in monitor display are detected, the optical axis of incident light is moved towards the core of the detected screen, the die length of the opposite side of the screen in the picturized monitor display is compared, a trapezoidal distortion is authorized, and an assay result adjusts the trapezoidal distortion of a projection screen.

[0016] Adjustment of a trapezoidal distortion can be performed by amending the display-image data which perform with the projector lens which has optical gate equipment, or are inputted into a projector lens.

[0017]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained with reference to a drawing.

[0018] For the block diagram in which drawing 1 shows the configuration of one example of the automatic screen justification equipment of the projector of this invention, and drawing 2, the flow chart of one example of this invention and drawing 3

are [the explanatory view of focus adjustment and drawing 5 of one example of the test pattern for focal adjustment and drawing 4] the explanatory views of projection screen justification.

[0019] In drawing 1 the automatic screen justification equipment of this example The projector lens 3 in which focus control, zooming, forward-and-backward inclination angle adjustment, and adjustment of a gate operation are possible, The monitor camera 4 installed in the front face of a projector body, and the focal detecting element 5 which detects the best point of the focus of an image inputted from the monitor camera 4, CPU7 of the edge detecting element 6 which detects the location of the screen in monitor display, and the operation part which computes a focal adjustment value, a zooming adjustment value, and a trapezoidal-distortion adjustment value, The display mechanical component 8 which adjusts a projector lens 3 and performs focal adjustment, zooming adjustment, forward-and-backward inclination angle adjustment, and trapezoidal-distortion adjustment, It has the input image data-conversion section 9 which changes an input image into an indicative data and is outputted to the display mechanical component 8, and is constituted by the projector 2 countered and fixed to a screen 1.

[0020] Next, drawing 2 explains actuation of this example.

[0021] First, a user starts automatic screen justification equipment, after making the body of a projector 2 ***** on a screen 1 and fixing.

[0022] Automatic screen justification equipment projects a predetermined test pattern from projector lens 3 SU of a projector 2, after initializing the set point of each part of a projector (step S1) (step S2). This test pattern has that good to which two or more perpendicular black straight lines are arranged in on white or a transparent flat surface to the scanning direction of a monitor camera, and the amplitude and frequency component of quantity of light change become high to a horizontal scan, as shown in drawing 3.

[0023] The test pattern on which it was projected from the projector is reflected by the wall surface of a screen and a screen in back etc. A monitor camera receives this reflected light and picturizes a projection screen (step S3).

[0024] The focal detecting element 5 analyzes the data of the picturized monitor image, and detects the best point of a focus by high order existence detection of a frequency component by the high place or the fourier expansion into series of peak value of a level signal etc. (step S4). [of the amplitude] in this case, the thing for which the best point of the focus for which it asks is doubled with one near the center of an image pick-up screen -- a thing can also make best the average foci of the whole screen including a

periphery.

[0025] If the best point of a focus is detected, next focal adjustment of a projector lens will be performed (step S5), the screen of all whites will be turned and projected in the direction of a screen from SUPUROJIEKUTA after that, and the monitor of the image will be carried out (step S6).

[0026] Next, the point that the brightness of the reflected light changes a lot on the horizontal scanning line of monitor display is detected, and the location of the screen in monitor display is detected as an endpoint of a screen (step S7).

[0027] Next, the projection range is reduced or expanded until it carries out zooming of the projector lens of a projector and a projection screen arrives at the endpoint of a screen (step S8).

[0028] Next, the sense of the front face of a projector body or the forward-and-backward inclination angle of a projector lens is adjusted so that the image of a screen may be located in the center of a screen in monitor display (step S9). The optical axis of a projector lens is turned to the core of a screen by this, and it is projected on an image in the center of a screen.

[0029] Next, the die length of the opposite side of the screen in the picturized monitor display is compared, a trapezoidal distortion is authorized, and an assay result adjusts the trapezoidal distortion of a projection screen (step S10). Detection of the location of the screen in the image pick-up screen of a monitor camera After focal adjustment implementation, turn all white screens in the direction of a screen, project them from a projector, and zooming of the projector lens of a projector is carried out. When the boundary point from which the total quantity of light of the monitor display is measured, reducing or expanding the projection range gradually, the effect of the reflected light from the background of a screen disappears, and the quantity of light of the whole monitor display serves as abbreviation regularity is detected, Zooming is stopped, the difference of the internal and external brightness around the screen which detected the location of the boundary point as an endpoint of a screen, and was detected in the location of a screen is compared for every side where the upper and lower sides and right and left counter, and the trapezoidal distortion generated around a projection image may be authorized.

[0030] Adjustment of a trapezoidal distortion can be adjusted by the CRT projector by changing the amplitude electrical-potential-difference range of a projection image by the location of a screen.

[0031] In a LCD projector, it can amend by justifying a projector lens (lens shift) and interpolating data electrically, using the "gate" effectiveness.

[0032] CPU7 computes the data for these amendments from edge detection data, and makes delivery, a screen frame, and a display image agree to the display mechanical component 6.

[0033] Moreover, in this example, although the monitor camera was used for focal adjustment, focal adjustment by the supersonic wave may be performed.

[0034] This example forms a monitor camera in the front face of a projector, picturizes and analyzes the test pattern on the screen projected from the projector with a monitor camera, by the analysis result, can perform automatically focal adjustment of a projector, zooming adjustment to a screen frame, and trapezoidal-distortion adjustment, and does not need to perform troublesome adjustment after the installation needed conventionally.

[0035]

[Effect of the Invention] it be effective in the ability to be able to adjust the screen location of a projector in a short time easily moreover also by the unskilled man by picturize the test pattern on the screen which projected this invention from the projector with the monitor camera as mentioned above , analyze the data , and perform automatically zooming adjustment to a screen frame , and trapezoidal distortion adjustment also out of focal adjustment of a projector by the analysis result , without perform troublesome adjustment after the installation needed conventionally .

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the configuration of one example of the automatic screen justification equipment of this invention.

[Drawing 2] It is the flow chart of one example of the automatic screen justification approach of the projector of this invention.

[Drawing 3] It is one example of the test pattern for focal adjustment.

[Drawing 4] It is the explanatory view of focus adjustment.

[Drawing 5] It is the explanatory view of projection screen justification.

[Description of Notations]

1. Screen
 2. Projector
 3. Projector Lens
 4. Monitor Camera
 5. Focal Detecting Element
 6. Edge Detecting Element
 7. CPU
 8. Display Mechanical Component
 9. Input Image Data Conversion Section
- S1-S10 Step

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